Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						4	C	H	0	/	2	C	Signature	

Paper Reference(s)

4CH0/2C

Edexcel IGCSE

Chemistry

Chemistry Paper 2

Mock Examination – January 2011

Time: 1 hour

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper.
Answer ALL the questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
Total	

Turn over

THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

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1. Alkenes are unsaturated hydrocarbons.

(a) State the general formula of all alkenes.

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(1)

(b) Draw the displayed formula of ethene.

(1)

(c) Alkenes can be shown to be unsaturated using bromine water. Describe the colour change that occurs when an alkene reacts with bromine water.

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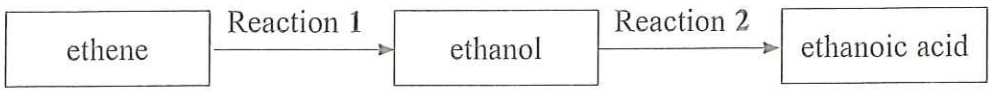
(2)

Leave blank

(d) Ethene is the starting material in the following sequence of reactions.



(i) State the other reagent, the catalyst, and one other condition used in Reaction 1.

Reagent .....

Catalyst .....

Condition .....

(3)

(ii) The reagents used in Reaction 2 are potassium dichromate(VI) and dilute sulphuric acid. State the type of reaction that occurs.

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(1)

(iii) Ethanoic acid, CH_3COOH, and ethanol, CH_3CH_2OH, react together to form ethyl ethanoate.
Give the structural formula of ethyl ethanoate and name the homologous series to which it belongs.

Structural formula

Name of homologous series .....

(2)

(Total 10 marks)

Leave blank

2. (a) The combustion of hydrogen gives out a lot of heat. What term is used to describe reactions that give out heat?

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(1)

(b) The atoms in a molecule of hydrogen are joined by a strong covalent bond.

What is a covalent bond?

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(2)

(c) Explain why hydrogen is a gas at room temperature.

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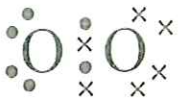
(2)

(d) A molecule of oxygen can be represented by a dot and cross diagram:



Draw a dot and cross diagram, showing only the outer electrons, to represent a molecule of water.

(2)

Leave blank

(e) The equation for the combustion of hydrogen is

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

The table shows the values of some average bond dissociation energies.

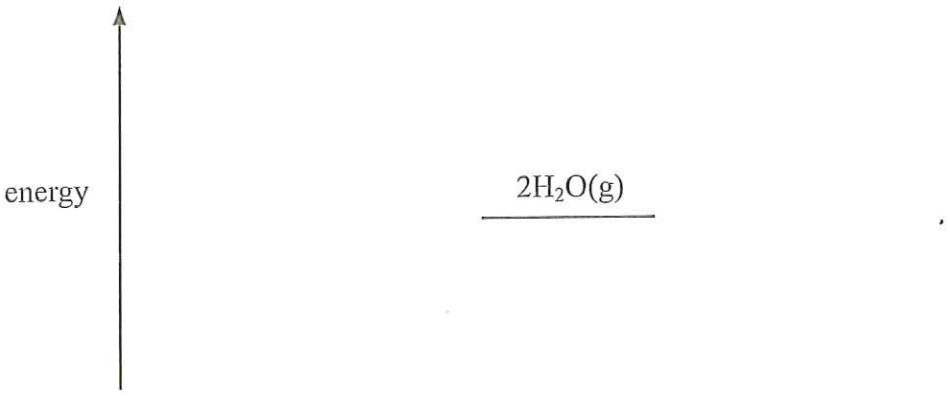
Bond	H—H	O=O	O—H
Dissociation energy (kJ/mol)	436	496	463

Use the values in the table to calculate the energy change for the combustion of hydrogen.

(3)

(f) The reaction can be represented by an energy level diagram.

Complete the diagram by inserting the reactants.



(1)

Leave blank

(g) On cooling, the $H_2O(g)$ produced in the combustion of hydrogen is converted into $H_2O(l)$.

Describe how the speed of, and the distance between, the particles change during this conversion.

Speed of particles .....

.....

Distance between particles .....

.....

(2)

(h) When water is added to white anhydrous copper(II) sulphate, blue hydrated copper(II) sulphate is formed.

Write a chemical equation for the reaction that occurs. Include state symbols in the equation.

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(3)

(Total 16 marks)

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3. Calcium sulphate can be prepared using a precipitation reaction between calcium chloride solution and dilute sulphuric acid.

$$CaCl_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HCl(aq)$$

(a) State three steps needed to produce a pure dry sample of calcium sulphate from the mixture formed in this reaction.

Step 1 .....

Step 2 .....

Step 3 .....

(3)

(b) A 5.55 g sample of calcium chloride ($M_r = 111$) is dissolved in water to make a solution.

(i) Calculate the amount, in moles, in the sample of calcium chloride.

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(2)

(ii) What amount, in moles, of sulphuric acid is needed to react completely with the calcium chloride solution?

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(1)

(iii) Calculate the relative formula mass of calcium sulphate. Use data from the Periodic Table on page 2.

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(1)

(iv) Calculate the mass, in grams, of calcium sulphate formed.

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(2)

Leave blank

(c) The following equation represents a reaction used to prepare the salt lead(II) nitrate.

$$PbCO_3(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(aq) + H_2O(l) + CO_2(g)$$

In this experiment the amount of nitric acid used was 0.0400 mol.

(i) The concentration of the dilute nitric acid used was 0.500 mol dm^{-3}. Calculate the volume, in cm^3, of dilute nitric acid used.

(3)

(ii) In this experiment, 0.0200 mol of carbon dioxide gas was produced. Calculate the volume, in cm^3, that this amount of carbon dioxide occupies at room temperature and pressure (rtp).
(molar volume of any gas = 24 000 cm^3 at rtp)

(1)

(Total 13 marks)

Leave blank

4. Chlorine is manufactured industrially by the electrolysis of concentrated sodium chloride solution in a diaphragm cell.
Hydrogen is formed at the negative electrode (cathode).
Chlorine is formed at the positive electrode (anode).

(a) Both electrodes are made from metal.
Describe the structure of a metal and explain why metals are able to conduct electricity.

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(3)

(b) (i) The negative electrode is made of steel (iron).

Suggest why steel is not suitable for making the positive electrode.

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(1)

(ii) Identify the metal from which the positive electrode is made.

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(1)

Leave blank

(c) The equation for the reaction at the positive electrode is

$$2Cl^-(aq) \rightarrow Cl_2(g) + 2e^-$$

A diaphragm cell was operated using a current of 100 000 A.

(i) Calculate the charge, in coulombs, passing in 2 minutes.

(2)

(ii) Calculate the amount, in moles, of chlorine molecules produced in 2 minutes. (One faraday is 96 000 coulombs).

(2)

(Total 9 marks)

Leave blank

5. When sodium hydroxide solution is added a drop at a time to a solution of aluminium sulphate, a white precipitate of aluminium hydroxide is formed. If excess sodium hydroxide is added the precipitate reacts to form a colourless solution.

A teacher uses the following method to investigate how the mass of precipitate formed changes as the volume of sodium hydroxide used is changed.

- Place 25 cm^3 of aluminium sulphate solution into a conical flask
- Add a known volume of sodium hydroxide solution to the conical flask
- Swirl the conical flask to mix the reagents together
- Measure the mass of the precipitate formed

(a) The table shows the teacher's results.

Volume of sodium hydroxide solution (cm^3)	Mass of precipitate (g)
0	0.00
1	0.00
2	0.06
3	0.13
4	0.26
5	0.29
6	0.26
7	0.20
8	0.17
9	0.05
10	0.00

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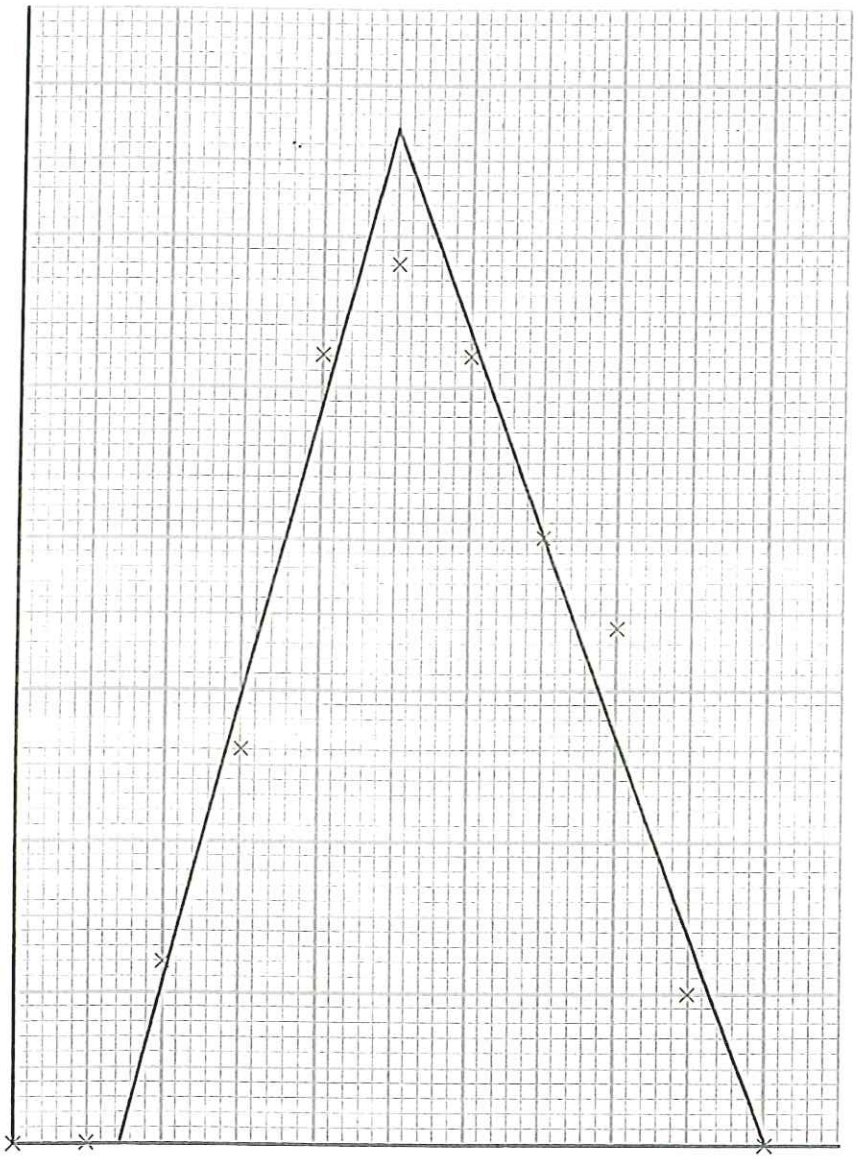
These results were plotted on a graph.

(i) Complete the graph by labelling the axes and writing suitable scales on them.



(2)

(ii) Use the graph to find the volume of sodium hydroxide that would produce 0.10 g of precipitate. Show your working clearly on the graph.

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(3)

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(iii) The teacher said he could not be sure exactly what volume of sodium hydroxide would produce the greatest mass of precipitate. What could he do to be more certain?

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(1)

(b) Describe how the teacher could find the mass of precipitate formed after he had mixed the two solutions together.

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(4)

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(c) Sodium hydroxide solution or ammonia solution can be added to salt solutions to help identify the positive ion present in the salt. The table shows the results of adding sodium hydroxide solution and ammonia solution to solutions containing different positive ions.

Positive ion in salt	Effect of adding sodium hydroxide solution		Effect of adding ammonia solution	
	a few drops	to excess	a few drops	to excess
aluminium	white precipitate	colourless solution	white precipitate	white precipitate
calcium	white precipitate	white precipitate	colourless solution	colourless solution
copper	blue precipitate	blue precipitate	blue precipitate	dark blue solution
zinc	white precipitate	colourless solution	white precipitate	colourless solution

A student adds a few drops of sodium hydroxide solution to a solution of a salt. A white precipitate forms. After adding sodium hydroxide solution to excess a colourless solution is obtained. The student concludes that the positive ion in the salt is aluminium.

(i) Explain why this conclusion may not be correct.

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(1)

(ii) Describe what the student could do to confirm his conclusion. State the result he should obtain if his conclusion is correct.

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(2)

(Total 13 marks)

END